

# Examining the Wealth Effect from Home Price Appreciation

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## **Abstract**

This paper identifies the importance of age and expected mobility as transmission channels for wealth effects from owner-occupied housing. I develop a model that considers the user cost of housing in calculations of net housing wealth. Solutions to the model demonstrate that changes in user cost cause changes in net housing wealth to be smaller than corresponding capital gains, and that this relationship differs across households according to age and expected mobility. I find that changes in the annuity value of net housing wealth are generally much smaller than capital gains, and that both age and mobility can have large, separate effects on the effect of housing gains on consumption.

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I use a maximum likelihood Heckman selection model on data from the Panel Study of Income Dynamics (PSID) to estimate household mobility, and use fixed effects regression to examine the links between housing gains, stock market gains, and consumption. Estimation results support many of the model's predictions. I find that the marginal propensity to consume out of housing gains increases with age, and that mobility can affect the response of consumption to housing gains for homeowners of all ages. I also find that housing gains have a larger effect on consumption than stock market gains.

# Introduction

Rising home prices over the past several years have fueled speculation about the impact of unanticipated changes in housing wealth on consumption. Most discussions about this topic equate increases in home prices with increases in wealth. While this is true for accounting wealth, it is not true for economic wealth. Increases in home prices lead to increases in economic housing costs, dampening the effect of housing capital gains on [economic] wealth. The precise relationship between housing capital gains and housing wealth depends on the homeowner's age, whether the homeowner plans to move into a more- or less- expensive home in the future, and the timing of any possible move.

In this paper, I examine the effect of unanticipated changes in housing wealth on consumption. In particular, I determine how age and expected mobility act as transmission channels from housing capital gains to changes in net wealth and consumption. Until recently, economic costs of housing have largely been ignored in the housing wealth effect literature. Exceptions to this include Campbell and Cocco (2005) and Li and Yao (2006). This paper explicitly models age and expected mobility separately, and discusses the relative impact of each factor.

In Section 2, I develop a simple life-cycle model to explain the effects of age and mobility on the response of consumption to windfall housing gains, and compare the marginal propensity to consume out of housing gains ( $MPC_{GAINS}$ ) with the marginal propensity to consume out of wealth ( $MPC_{WEALTH}$ ).

Analytical solutions to the model yields predicted  $MPC_{GAINS}$  for households with different age and mobility profiles. The model predicts that  $MPC_{GAINS}$  increases with age, and that  $MPC_{GAINS}$  is generally less than  $MPC_{WEALTH}$ . The marginal effect of mobility on  $MPC_{GAINS}$  decreases with the relative price level and appreciation rate of the future home, and the magnitude of this effect decreases with the length of tenure in the current home.

In Section 3 of the paper, I use the model’s predictions to interpret data from the 1984-2003 waves of the Panel Study of Income Dynamics (PSID). Regressions using household-specific fixed effects show that  $MPC_{GAINS}$  increases with age. I also estimate each household’s probability of a move and future home value using a maximum likelihood Heckman selection model. Incorporating mobility estimates into the regression equation suggests that for certain age groups, households that expect to move into more expensive homes have larger  $MPC_{GAINS}$  than the average household. Section 4 concludes.

## 1 Literature

Theoretical literature on the wealth effect from home price appreciation has offered mixed findings. A model of housing costs presented by Dougherty and Van Order (1982) suggests that for an infinitely-lived homeowner, changes in housing prices should be exactly offset by changes in housing costs. Within his study of the impact of bequests on the housing wealth effect, Skinner (1989) notes that finite-lived consumers may have positive wealth effects from home price appreciation. Campbell and Cocco (2005) also use a life-cycle model to examine the wealth effect from home price appreciation. Their results suggest a large, positive wealth effect for old homeowners, and an effect that is close to zero for young renters. This zero effect for young renters is driven by young renters substituting non-durable consumption for housing consumption when home prices rise. Li and Yao (2006) develop a life-cycle model with borrowing constraints to predict that the non-housing consumption of young and old homeowners is more sensitive to home price changes than middle-aged homeowners.

Empirical literature has likewise offered mixed results. Juster, Lupton, Smith and Stafford (2006) estimate zero effect of housing capital gains on consumption for a sample of PSID households over the period 1984-1994. Using data joined from

the PSID and the Consumer Expenditure Survey (CEX) over the period 1976-1981, Skinner (1989) finds no effect of home values on consumption when using fixed effects regression. When he uses a pooled regression, however, he estimates a home value consumption elasticity of 0.06%. A back of the envelope calculation using mean home values and imputed consumption from the 1984-1989 waves of the PSID (the closest available to that time period) suggests that this elasticity is equivalent to a  $MPC_{GAINS}$  of approximately 0.02<sup>1</sup>. Case, Quigley and Shiller (2005) estimate a home price consumption elasticity of between 5% and 8% in US state-level data. Using mean home values and imputed consumption from the PSID, this translates into  $MPC_{GAINS}$  between 0.02 and 0.04. A recent working paper by Bostic, Gabriel and Painter (2005) uses matched household-level data from the Survey of Consumer Finances and the CEX to estimate a home value elasticity of approximately 6%. Using PSID data over the same period, this translates into a  $MPC_{GAINS}$  of approximately 0.02. Engelhardt (1996) uses OLS on a cross-section of PSID households to estimate that  $MPC_{GAINS}$  is 14.2 cents. Using median regression to reduce the effect of outliers, the estimated  $MPC_{GAINS}$  falls to only 2.4 cents. Campbell and Cocco (2005) use repeated cross-sections of household expenditure data and regional home price information to estimate a small, positive consumption response to home prices for young homeowners, and a large positive response for old homeowners. Using mean home values and consumption as reported in their paper, this translates into  $MPC_{GAINS}$  of 0.06 for young homeowners, and 0.11 for old homeowners.

The paper that is most closely related to this work is that by Campbell and Cocco, though the two papers differ in some modelling assumptions and empirical approach. First, although their model could handle a scenario in which all households are homeowners, much of the variation in wealth effects by age in Campbell and

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<sup>1</sup>Consumption is imputed by subtracting average annual “active savings” from current income. Active savings is composed of contributions to assets, net of capital gains, and is discussed in greater detail in Section 3.

Cocco’s model is driven by borrowing constraints faced by renters who desire to be homeowners. The model presented in this paper allows examination of the separate factors of age and mobility on wealth effects, without possibly confounding effects of borrowing constraints or age-related mobility. Second, the data used by Campbell and Cocco differs greatly from that used in this paper. This paper uses data on a true panel of U.S. households, allowing identification of household-specific changes in housing wealth and consumption. Campbell and Cocco create a synthetic panel of U.K. households by combining cross-sectional household-specific expenditure data from the Family Expenditure Survey with regional and national home price data. The nature of their dataset makes it impossible to identify those households for which the wealth effect should be largest.

## 2 Theory

### 2.1 Housing Demand & Costs

In this section, I present a theoretical model of the housing sector that follows Dougherty and Van Order (1982) and Poterba (1984). I use partial equilibrium analysis to focus on the effect of changing home prices on consumption, and do not consider how changes in demand or supply may affect home prices.

In equilibrium, a home’s price should equal the present value of its expected service flows. The per-period net service flow from a house owned by household  $i$  is equal to the payment one would need to rent that house  $R$ , minus any “upkeep costs” built into the rent.

$$S_{i,t} = R_{i,t} - [(1 - \tau_y)\tau_p + \delta]H_{i,t} \tag{1}$$

Upkeep costs, which include property taxes ( $\tau_p$ ) and depreciation and maintenance

( $\delta$ ), are expressed as fractions of the real home price,  $H$ . Property taxes are deductible from federal income taxes, so they are included on an after-income tax ( $\tau_y$ ) basis.

The equivalent rent for a home,  $R$ , is a function of the existing housing stock  $K$ . In equilibrium,  $R_{i,t}(K_t)$  should be equal to the marginal cost of using a unit of housing services ( $u$ ).

$$R_{i,t}(K_t) = uH_{i,t} \quad (2)$$

The marginal cost of housing services is often referred to as the “user cost” of housing. User cost is expressed as a proportion of the real home price, and includes property taxes, depreciation, and the real opportunity cost of funds dedicated to housing, less any expected real home price appreciation  $\pi_h$ . The real opportunity cost of funds dedicated to housing is equal to the nominal after-tax one-period interest rate  $i(1 - \tau_y)$ , minus the inflation rate  $\pi$ . I assume that user cost and its components are constant over all periods.

$$u = \delta + (1 - \tau_y)(i + \tau_p) - \pi - \pi_H \quad (3)$$

Equating a home’s price to the present discounted value of all future service flows yields Equation 4.

$$H_{i,t} = \sum_{t=0}^{\infty} \frac{S_{i,t}}{(1 + r)^t} \quad (4)$$

Asset price equilibrium ensures that the real interest rate,  $r$ , is equal to the after-tax real cost of capital.

$$r = (1 - \tau_y)i - \pi \quad (5)$$

## 2.2 Net Wealth & Consumption Function

Net economic housing wealth  $W_{h_{i,t}}$  is equal to the value of the home ( $H_t$ ), less the present value of the lifetime cost of housing. In other words, it is equal to the present

value of services provided by the home minus the present value of the costs of housing. If households are infinitely-lived and there are no frictions, net housing wealth would be equal to zero: the benefits and costs of housing would exactly offset one another. If, however, consumers have finite lives of length  $T$ , net housing wealth will be positive and nonzero. Positive net housing wealth arises because the price of the home is determined by its infinite useful life (Equation 4), while the household incurs periodic housing costs (Equation 3) only for its finite lifetime of  $T$  years.

$$W_{h,i,t} = \sum_{t=0}^{\infty} \frac{S_{i,t}}{(1+r)^t} - \sum_{t=0}^T \frac{uH_{i,t}}{(1+r)^t} \quad (6)$$

This interpretation of positive net housing wealth applies to homeowners who have both finite lifetimes and finite planning horizons. Dynastic households, in which the homeowner fully incorporates the welfare of future generations when making consumption decisions, would have infinite planning horizons, and economic housing wealth would always be zero. If, however, a homeowner plans to leave a fixed amount of money to his or her heirs, then changes home prices would still affect net housing wealth.

Net housing wealth does not explicitly include the mortgage balance or rate. This model considers economic housing wealth, which, in a frictionless world, should be independent of the method of financing. In the absence of market frictions, the after-tax mortgage rate should be equal to the return that could be earned on equity and economic housing wealth would be unrelated to the method of financing. Empirical tests of this model should be equivalent to those that incorporate housing debt, as windfall changes in home equity due to home price changes are independent of the mortgage balance.

Substituting Equation 4, the formula for home prices, into Equation 6, yields

$$W_{h,i,t} = H_{i,t} - \sum_{t=0}^T \frac{uH_{i,t}}{(1+r)^t} \quad (7)$$

Equation 7 demonstrates that, all else equal, net housing wealth is higher for consumers with shorter expected lifetimes.

I assume that housing is indivisible. In real life, housing consumption can only be changed via moving, construction, or demolition- all of which are expensive and time-consuming. Anyone who has ever purchased a house, or even moved from one rented home to another, would agree that moving costs (e.g. searching for a new home, time packing, transaction costs) can be prohibitively high. These costs suggest that homeowner mobility would resemble a sort of S-s model. Within certain bounds, households will be content to be over- or under-housed, until the difference between their desired and actual consumption outweighs the costs associated with moving. Consequently, I assume that the quantity of housing units consumed is inelastic with regard to the price of housing. Although this will not be true for all households over all price changes, it serves as a useful approximation for many households and is especially appropriate for owner-occupied housing.

In keeping with this assumption, I model the household's consumption function as a function of lifetime wealth, net of housing costs<sup>2</sup>. I assume that the marginal propensity to consume out of wealth,  $MPC_{WEALTH}(\mu(T))$ , is determined according to the permanent income hypothesis and varies with age. Values of  $\mu(T)$  for different life expectancies (values of T) can be seen in Appendix A. Per-period income is equal to  $y_t$ , and initial other assets are equal to  $A_0$ . Consumers are risk-neutral.

$$c_{i,t} = \mu(T) * \left[ A_0 + \sum_{t=0}^T \frac{y_{i,t}}{(1+r)^t} + H_{i,0} - \sum_{t=0}^T \frac{uH_{i,t}}{(1+r)^t} \right] \quad (8)$$

I include windfall housing gains as changes in  $\epsilon_0$ , one-time percentage gains in

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<sup>2</sup>See appendix for derivation of the household's consumption function.

initial home prices.

$$H_{i,t} = H_{i,t-1}(1 + \epsilon_{i,t})$$

$$E_{t-1}[\epsilon_{i,t}] = 0$$

Consumption's response to housing gains depends on how net housing wealth responds to housing gains. As previously discussed, age differences will cause the relationship between net housing wealth and capital gains to differ across consumers. This should result in different observed marginal propensities to consume out of housing gains ( $MPC_{GAINS}$ ). The  $MPC_{GAINS}$  should not be confused with  $MPC_{WEALTH}$ , which is unaffected by housing gains.

In keeping with the structure of most home price series, I model home price changes as percentage changes in home prices. Thus, to solve for  $MPC_{GAINS} = \frac{dC}{dH}$ , I must solve for  $\frac{dC}{d\epsilon} * \frac{1}{H}$  at  $t = 0$ <sup>3</sup>.

$$\frac{dc_{i,t}}{d\epsilon_{i,t}} = \mu(T) * H_{i,t-1} \left[ 1 - \sum_{t=0}^T \frac{u}{(1+r)^t} \right] \quad (9)$$

$$MPC_{GAINS} = \mu(T) * \left[ 1 - \sum_{t=0}^T \frac{u}{(1+r)^t} \right] \quad (10)$$

Adding expected mobility to the model requires simple modifications. I assume that households plan at most one future move, as it is likely that households plan for only one future move at a time. I also assume that both the move's timing and the relative price of the new home are independent of any housing gains. This type of scenario would apply to a household with school-age children that plans to move into a more expensive home in a better school district, or a household expecting a job transfer to a new city. Admittedly, this assumption is unlikely to hold for

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<sup>3</sup> $MPC_{GAINS} = \frac{dC}{dH} = \frac{dC}{\frac{dH}{H}} * \frac{1}{H} = \frac{dC_t}{d\epsilon_t} * \frac{1}{H_t}$

all households. Should the price of a household's planned future home increase by much more than that of their current home, a household may choose to substitute towards non-housing consumption. Thus, one could view this model as a method of establishing upper bounds for the magnitudes of the predicted effects of mobility on consumption.

I denote the value of household  $i$ 's the planned second home relative to the original price of the current home as  $\gamma_i$ .  $\gamma_i$  is an historical variable, and does not change if the household experiences windfall gains.  $\gamma_i > 1$  if the original price of the future home is greater than the price of the current home. The appreciation rate of the new home is also allowed to vary, allowing for the possibility of migration across metropolitan areas. If a household plans to move to a new city, the price of the household's future home is likely to appreciate at a different rate than the household's current home.  $\theta_i$  is the appreciation rate of household  $i$ 's new home relative to the original home,  $\frac{\epsilon_{i,t}^2}{\epsilon_{i,t}^1}$ <sup>4</sup>.  $\theta_i > 1$  if the price of the future home ( $H_{2,i,t}$ ) appreciates by a greater percentage than the price of the current home ( $H_{1,i,t}$ ). If the household plans move within its current metropolitan area,  $\theta_i$  would likely be close to 1.

$$H_{i,t}^2 = H_{i,t-1}^2(1 + \theta_i \epsilon_{i,t}^1) \quad (11)$$

$$\gamma_i = \frac{H_{i,t}^2}{H_{i,t}^1} \quad (12)$$

Assuming that any future move occurs at the end of period  $K$  modifies Equation 7, lifetime net housing wealth, as follows:

$$W_{h,i,t} = H_{i,t}^1 - \sum_{t=0}^K \frac{uH_{i,t}^1}{(1+r)^t} + \left( \frac{H_{i,K}^1}{(1+r)^K} - \frac{H_{i,K}^2}{(1+r)^K} \right) - \sum_{t=K+1}^T \frac{uH_{i,t}^2}{(1+r)^t} \quad (13)$$

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<sup>4</sup>The interesting cases are those for which  $\epsilon_{i,t}^1 \neq 0$ .

Households' net housing wealth is equal to their current claim to housing services,  $H_{i,t}^1$ , minus the total cost of living in the current home, plus the expected difference between the price of the current home and the future home (any "long"/("short") position in housing), minus the total cost of living in the future home.

The  $MPC_{GAINS}$  can again be found by taking the derivative  $\frac{dc_{i,t}}{d\epsilon_{i,t}}$  of the consumption function (Equation 14) and dividing by the initial home price,  $H_{i,t-1}^1$  :

$$C_{i,t} = \mu(T) * \left[ A_0 + \sum_{t=0}^T \frac{y_{i,t}}{(1+r)^t} + W_{h_{i,t}} \right] \quad (14)$$

$$MPC_{GAINS} = \mu(T) * \left[ \left( 1 - \sum_{t=0}^K \frac{u}{(1+r)^t} \right) + \frac{1 - \gamma_i \theta_i}{(1+r)^K} - \gamma_i \theta_i \sum_{t=K+1}^T \frac{u}{(1+r)^t} \right] \quad (15)$$

The effect of a planned future move on  $MPC_{GAINS}$  depends on the time until the move,  $K$ , the remaining lifetime  $T$  of the household, the initial relative price of the future home,  $\gamma_i$ , and the appreciation rate of the future home relative to the current home,  $\theta_i$ .

### 2.3 Predicted $MPC_{GAINS}$

Calibrating and solving the model yields predictions of  $MPC_{GAINS}$ . All else equal, households with shorter expected lifetimes have larger increases in net housing wealth for a given housing gain, and consequently should exhibit larger  $MPC_{GAINS}$ .  $MPC_{GAINS}$  falls with increases in the price or relative appreciation of the planned future home, as higher lifetime costs reduce lifetime net housing wealth. The influence of expected mobility on  $MPC_{GAINS}$  diminishes with the number of years until a move.

Predicted results are sensitive to the model's calibration. Inflation and the nominal interest rate both have large impacts on predicted  $MPC_{GAINS}$ , largely due to their importance in the discount rate. With this in mind, I chose parameter values

according to two criteria: that they reflect empirical data when considered individually, and that they yield a reasonable real interest rate when used in Equation 5. I chose parameters that yield a real interest rate of 3.2%, which is comparable to the average real rate of 3.1% observed between 1984 and 2003<sup>5</sup>.

I set the marginal tax rate equal to 20% for all households, and assume that property taxes and depreciation are both equal to zero<sup>6</sup>. General price inflation is constant and equal to 2%, and there is no expected change in real home prices. The nominal one-period interest rate is 6.5%.

Table 1 demonstrates that age has a very large impact on the predicted value of  $MPC_{GAINS}$ . Predicted  $MPC_{GAINS}$  for a household that doesn't plan to move and expects to live for another 60 years (approximately 18 years old<sup>7</sup>) is less than one cent, while the predicted  $MPC_{GAINS}$  for a household that plans to live for another 20 years (approximately 62 years old) is almost 3.5 cents. Predicted  $MPC_{GAINS}$  for a household expecting another 5 years of life (approximately 89 years old) is 15.5 cents.

The importance of age in determining  $MPC_{GAINS}$  is rather surprising. Most papers that consider the effect of age on the housing wealth effect do so only as a proxy for expected mobility. Younger households are expected to move into more expensive homes, and older households are expected to move into less expensive homes. Data from the PSID covering the period 1984 - 2003 demonstrate that this assumed pattern may be an oversimplification. Almost 33% of homeowners aged 65 and over who choose to move, move into a more expensive home, compared to 44% of moving homeowners aged 34 and younger. These data recommend evaluating age on its own merits. Age affects  $MPC_{GAINS}$  through two channels: first, by determining the period over which housing costs are incurred, and thereby affecting net wealth,

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<sup>5</sup>This was calculated using market yield on one-year constant maturity Treasury securities as the nominal interest rate, and the 1996 GDP deflator series for inflation.

<sup>6</sup>In this model, the marginal tax rate is equal to the average tax rate. 20% is comparable to the average tax rate as calculated by the NBER TAXSIM model, available at <http://www.nber.org/taxsim>. (Feenberg and Coutts 1993)

<sup>7</sup>Age-specific conditional life expectancy is drawn from Arias (2004)

and second through its effect on  $MPC_{WEALTH}$ , determining the annuity value of wealth increases.

Comparison of  $MPC_{WEALTH}$  (shown in the Appendix) and  $MPC_{GAINS}$  illustrates the importance of considering user cost when evaluating the effect of capital gains.  $MPC_{WEALTH}$  for a household with 40 years left to live is equal to 0.041, but the household's  $MPC_{GAINS}$  (if it doesn't plan to move) is only equal to 0.012. If capital gains were equal to increases in net wealth, a household's predicted response to a \$10,000 gain would be an annual consumption increase of \$410. Considering user cost leads to a predicted response of only \$120 per year.

Mobility has been emphasized in the literature as the main reason that housing wealth effects should vary across households, while the independent effect of age has been largely ignored. A comparison of Table 1, which shows  $MPC_{GAINS}$  across age groups, with Tables 2 and 3, which show the difference between  $MPC_{GAINS}$  for movers and non-movers for different price scenarios, demonstrates that age is just as important. If all houses appreciate at the same rate, and movers plan to purchase homes that are initially 50% less expensive,  $MPC_{GAINS}$  is at most 9.5 cents greater for movers than for non-movers (Table 2). Though this marginal effect of moving may seem quite large, it applies to households with a conditional life expectancy of only five years—corresponding to homeowners with approximately 89 years of age. This would apply to a very small proportion of the population. It also relies on the household planning to move in 1 year. For households approximately 62 years of age, the  $MPC_{GAINS}$  of movers is greater than that of non-movers by only 4.4 cents.

The timing of any possible move also affects  $MPC_{GAINS}$ . Moves that occur farther in the future have smaller effects on  $MPC_{GAINS}$ , due to a shorter period of time incurring costs of the second home, and to the present value discounting of those costs. If a household's expected lifetime is 60 years, the effect of a move that occurs 20 years into the future is approximately half of the size of the effect of moving in 1

year.

Table (3) demonstrates that the marginal effect of moving to a home that is initially 50% more expensive is symmetrical to that of moving to a home that is initially 50% less expensive.

The effect of potential migration is shown in Table (4). Differences in rate of price appreciation across the current and future home magnifies the effects of expected mobility. If the price of the planned future home was initially 50% more expensive than the current home, and its price appreciation is double that of the current home, moving reduces  $MPC_{GAINS}$  by 17.5 cents for a household that has 20 years remaining lifetime and plans to move within one year. Doubling the rate of price appreciation of the new home almost quadruples the marginal effect of moving.

### 3 Empirical Analysis

Estimation of the wealth effect from home price appreciation is made difficult by the lack of appropriate data. Datasets tend to have good information on either expenditures or on wealth. Those that contain both types of information are generally limited in scope. The Health and Retirement Study (HRS) contains excellent data on both expenditures and wealth; however, it focuses entirely on households aged 50 and over, and is therefore unsuitable for examination of wealth effects across the age spectrum. Other surveys with information on asset and expenditure data, such as the CEX, lack any panel component. These data limitations have led many to create synthetic panels of data, including Skinner (1989) and Campbell and Cocco (2005), and others to use aggregate data (Case et al. 2005).

More recent waves of the PSID offer a solution to this problem. For the five year periods ending in 1989, 1994 and 1999, and biannually ever since, the PSID has asked respondents for detailed data on wealth stocks and flows that can be used to

impute household expenditures over those periods. Earlier studies, such as Engelhardt (1996) and Juster et al. (2006) have also used this method to evaluate wealth effects. I follow these authors and construct a measure of non-housing “active savings” for each household  $i$ , consisting of purchases of assets, net of capital gains. It is equal to the change in total non-housing wealth over the period, less capital gains, inheritances and gifts, and net transfers of assets by people moving into or out of the household.<sup>8</sup> Active savings represents the amount of current income that is saved, rather than spent. Thus, all else equal, an increase in active savings represents an equivalent decrease in consumption.

I use the fixed effects estimator to estimate the effect of capital gains on non-housing active savings ( $AS$ ). Fixed-effects regression allows a separate intercept  $\alpha_i$  for each household  $i$ , eliminating any bias that may come from time-invariant household-specific omitted variables such as household-specific preferences for savings. The fixed effects estimator allows this intercept to be correlated with other explanatory variables  $X$ , such as income. This estimation method is equivalent to a regression of deviations from household-specific means.

$$AS_{i,t} = X_{i,t}\beta + \alpha_i + \epsilon_{i,t} \quad (16)$$

Explanatory variables include age of the household head, housing capital gains (in dollars), stock market capital gains (in dollars), average family income, and change in family income. I use the White heteroskedasticity-consistent variance estimator, and allow errors to be correlated within households.

Dummy variables for each year are included to capture the effect of interest rate changes or other macroeconomic factors that could affect household savings behavior.

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<sup>8</sup>Total non-housing wealth is generated and reported by the PSID for the years 1989, 1994, 1999, 2001, and 2003. I calculate total non-housing wealth for 1984 by subtracting net housing equity from total wealth.

(This could be written as a time-invariant error term in the regression equation,  $\alpha_t$ ). Regressions are estimated for households that were homeowners over the entire period.<sup>9</sup>

### 3.1 Data

The PSID is a longitudinal study conducted annually between 1968 and 1997 and biannually ever since. Home value and demographic data are available from 1968 onwards. As discussed, active savings for each household can be calculated on a periodic basis for the years 1989-2003.

The specific wealth categories used to calculate active savings include net purchases of stocks, annuities, real estate (other than the primary home), net investments in farms or businesses, and changes in non-collateralized debt.<sup>10</sup> Active savings for household  $i$  between periods  $t$  and  $t + j$  is calculated as follows:

$$\text{Active Saving}_{i,t,t+j} = \Delta \text{non-housing wealth}_{i,t,t+j} - \text{Financial Capital Gains}_{i,t,t+j}$$

I exclude any cases with inheritances or transfer of assets by movers into or out of the household because the form of the asset inherited or transferred is not reported in the PSID, but does affect calculation of capital gains and active savings. Table 5 illustrates this problem.<sup>11</sup>

Capital gains over the wealth reporting period  $t, t + j$  are calculated for assets in non-home real estate, farm or business, stocks, and IRAs (including private annuities).

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<sup>9</sup>Regressions were also estimated including households that transitioned from owning to renting over the period, calculating capital gains as the sum of capital gains for periods in which they were owners. Results are were very similar to those including only households that remained owners throughout the period, and are available upon request.

<sup>10</sup>In 1999, 2001 and 2003, respondents were asked specifically about holdings of private annuities or IRAs. Prior to 1999, holdings of stocks or bonds in IRAs were considered part of stock holdings or “other assets”.

<sup>11</sup>Had these cases been included, any inheritance or transfer should also be subtracted from active savings because they represent changes in wealth that are unrelated to income or consumption.

$$\begin{aligned} \text{Capital gains}_{i,t,t+j} = & (\text{Real estate value}_{i,t,t+j} - \text{Real estate value}_{i,t}) - (\text{Real estate purchases}_{i,t,t+j} - \\ & \text{Real estate sales}_{i,t,t+j}) + (\text{Business value}_{i,t,t+j} - \text{Business value}_{i,t}) - (\text{Business purchases}_{i,t,t+j} - \\ & \text{Business sales}_{i,t,t+j}) + (\text{Stock value}_{i,t,t+j} - \text{Stock value}_{i,t}) - (\text{Stock purchases}_{i,t,t+j} - \text{Stock sales}_{i,t,t+j}) + \\ & (\text{IRA value}_{i,t,t+j} - \text{IRA value}_{i,t}) - (\text{IRA purchases}_{i,t,t+j} - \text{IRA sales}_{i,t,t+j}) \end{aligned}$$

The term “stock” is used loosely to refer to stock in publicly held corporations, mutual funds, and investment trusts. Before 1999, “stocks” also includes stocks held in IRAs. From 1999 onwards, holdings in IRAs are reported. Before 1999, capital gains in stock portions of the IRA would be captured in the measure stock gains. Capital gains in government or corporate bonds are missed throughout the interview period, as bonds are only captured in “other assets”, for which purchase and sale questions are not included.

Calculation of housing and stock capital gains variables that are used as explanatory variables must account for the timing of any gains experienced in that wealth reporting period. As discussed in Section 2, any gain or loss should affect consumption (and active saving) permanently. Consider the wealth reporting period 1984-1989. A gain or loss incurred between 1984 and 1985 should affect active savings for every year of the five year period, whereas a gain incurred between 1988 and 1989 should affect active savings for only one year. To account for this effect, I multiply each annual gain by the number of years that it should affect consumption in that wealth reporting period. If a gain variable is not available annually (e.g. stock gains, and post-1997 house gains), I multiply the gain by the average number of years it might affect consumption over the wealth reporting period.

For example, suppose wealth and real estate improvements are reported at periods  $t$  and  $t+5$ , and home values are reported annually. In that case, housing capital gains are as follows:

$$\text{Housing capital gains}_{i,t+5} = 5 * \text{gains}_{i,t,t+1} + 4 * \text{gains}_{i,t+1,t+2} + 3 * \text{gains}_{i,t+2,t+3} + 2 * \text{gains}_{i,t+3,t+4} + 1 * \text{gains}_{i,t+4,t+5} - 3 * \text{improvements}_{i,t,t+5}$$

Housing capital gains are calculated only for periods in which the household was a homeowner, and are set equal to zero for any period in which the household moves. There are several instances in which households don't report having moved, but do report a change in ownership status with a corresponding change in home value. Capital gains for any period in which there is an ownership transition (even without a move) are set equal to zero.

Average family income for a wealth reporting period is the simple average of annual incomes. I annualize flow variables by taking the average over the pertinent period, and convert all wealth and income variables to real, 1996 dollars.

Exclusion of changes in housing wealth from active saving relies on the implicit assumption that active saving in housing does not change in response to windfall housing gains. In other words, I assume that homeowners do not alter their mortgage payments or make home improvements when home values unexpectedly rise. This assumption seems more reasonable for earlier years of data: the percentage of households reporting additions or improvements to real estate over the PSID's \$10,000 threshold rises from 8% over the five year period between 1984 and 1989 (1.6% per year) to 8% over the two year period 2001-2003 (4% per year). If housing gains do encourage households to make real estate improvements, excluding improvements may understate active savings.'

I break households into three categories, depending on the age of the household head. Category 1 includes households aged 34 and under. Category 2 includes households aged 35 through 49. Category 3 includes households aged 50 and older. Each age group represents approximately one third of the sample.

My analysis relies on calculating changes in household wealth variables. If the reported level of a variable is top coded or bottom coded, it is impossible to calculate true changes in the level of that variable. Consequently, I exclude all top- or bottom-coded observations, rather than Winsorizing censored data. Several cases are dropped to keep bottom coding consistent across years. Stock value, business value, non-home real estate value, net proceeds from sale of business, net proceeds from sale of real estate, and net proceeds from sale of stock all report negative values in 1989, but not in other years. Business value only reports negative values in 2003. I exclude all cases with negative values for these variables. I also drop observations for which the respondent replied “don’t know” or refused to answer.

Visual inspection of PSID data suggests that outliers due to coding error may obscure the relationships between the explanatory variables and active savings. For example, a household reported a nominal home value of \$4,000 in 1991, \$35,000 in 1992, \$3,000 in 1993, and \$5,500 in 1994, and did not report moving in that time frame. The reported value of \$35,000 should likely represent a value of \$3,500. I drop cases such as this by excluding cases for which active savings, % capital gains in stocks, % capital gains in housing, and annualized change in family income fall within the top or bottom 1% of observations. I also exclude the the top 1% of observations of average family income as outliers.<sup>12</sup> The number of cases that are dropped by excluding outliers is noted in Table 6, and their effects on summary statistics are shown in Table 7.

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<sup>12</sup>The % capital gain in home is the only variable that is available every interview between 1984 and 2003. If a household’s reported housing capital gain is in the top or bottom 1% of observations for a given year, then the household is marked as an outlier for the entire reporting period. For example, suppose a household reports a housing capital gain in 1992 that is in the 99th percentile. The household would be marked as an outlier for the entire 1989-1994 wealth reporting period. All other variables are available only once in each wealth reporting period.

### 3.2 Regressions Examining Effect of Age

I begin with a baseline regression that forces the relationship between capital gains and active savings to be constant across households of different ages. As illustrated by the model in Section 2, the response of active savings to capital gains should depend on the age of the household, so this regression is not likely to represent the true effects of home price appreciation on savings.

The point estimate for housing capital gains is equal to zero, rather than negative as the model predicts. This finding is consistent with those of Engelhardt (1996) and Juster et al. (2006), who also find zero effect of housing gains when using household-specific fixed effects. This finding could be driven by the age effect of young households, who have very little predicted effect of changes in housing wealth on consumption. It could also reflect heterogeneous household mobility: a zero effect would be consistent with some households planning to move into more expensive homes, and others planning to stay in their homes or downsize. The estimated effect of stock gains is also zero, rather than negative as predicted by the model.

The coefficient on average annual income should approximate the active saving rate, the average proportion of income converted to non-housing active saving. The estimated coefficient on this variable has the expected positive sign, and is equal to 0.07. Annualized change in family income is included to proxy for expected future income growth, and is expected to have a negative coefficient. Households with high past income growth may expect to have high future income growth, and would save less out of current incomes than households with lower expected income growth rates. The coefficient on this variable is not significantly different from zero at the 10% level.

Regression II allows the response of active savings to capital gains to vary by age. Solutions to the model in Section 2 suggest that, all else equal, the link between active savings and capital gains should be negative, and that the strength of this relationship should increase with age. Results of this regression support the model's

general pattern of predictions by age. The coefficient on housing gains for older households is significantly more negative than that for young households (the omitted age category) at the 5% level. The coefficient on housing gains for young households is equal to 0.15, suggesting that they increase active savings when home prices rise. The omitted mobility variable helps explain this response. The majority of households who move from one owner-occupied home to another move into more expensive homes, and young households are more likely to move than older households. If young households plan to move into more expensive homes within the same geographical area, they should increase active savings when home prices rise.

The estimated responses for households aged 35 and older are both -0.01, equal to  $MPC_{GAINS}$  of 0.01. Holding mobility constant, households aged between 35 and 50 have a predicted  $MPC_{GAINS}$  of 0.012—almost exactly the value estimated by the regression. Households aged 50 and older have a predicted  $MPC_{GAINS}$  equal to 0.034. The slightly lower estimated response could reflect presence of a bequest motive, though the predicted value is within the 95% confidence interval around the estimate.

The estimated responses to stock market gains are negative for all age groups, though none of are significantly different from zero at the 10% level. This result is surprising. Assets held in stocks do not have the associated “user cost” associated with owner-occupied housing, so economic wealth should change by the full amount of any stock capital gains or losses. In the absence of liquidity constraints, transaction costs, or other market frictions, the relationship between stock market gains and active savings should be determined by the household’s age-appropriate  $MPC_{WEALTH}$ . As shown in the Appendix, the predicted effect of a dollar increase in stock market wealth on active savings for the youngest group should be between -3.4 cents and -4.1 cents. Though these values are well within the 95% confidence interval around the point estimate, the lack of precision around estimates for stock gains suggests

that other factors may be affecting the relationship between stock gains and active savings. Estimated responses to average family income and change in family income are virtually unchanged from those estimated in Regression I.

I also experiment with dropping households with major changes in family composition, such as marriage, divorce, or a new head of household, in case active savings for these households changes for reasons that are not directly related to changes in wealth or income. I find that dropping households with major changes in family composition has little effect.

### 3.3 Predicting Expected Mobility

I introduce expected mobility by predicting the expected value of a future home for each household.

Using an unbalanced panel of PSID homeowners over the period 1975 through 2003, I estimate each household's likelihood of making at least one move in the next 10 years, and the relative value of the future home<sup>13</sup>. Due to limited data availability, I am only able to predict whether the household is likely to move into a more or less expensive home, not whether the households is likely to migrate to another geographical area. I then use the coefficients from the mobility estimates to predict the expected value of a future home for each household in the active savings sample.

I jointly estimate the likelihood of moving and relative value of a future home purchase using a maximum-likelihood Heckman sample selection procedure. Presumably, the factors that affect a household's decision to move are related to the factors determining the quantity of housing purchased in case of a move. For example, households facing very high moving costs would move less frequently, and make larger adjustments to household consumption when they do move. If moving costs are not perfectly measured, this could result in a negative correlation between the

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<sup>13</sup>Due to data limitations, the actual time horizon used varies between 10 and 11 years in the future.

household's probability of moving and relative trade value. This correlation between the error terms means that estimating a household's relative value of a trade by using OLS on a sample of trade values for mover households would yield biased results. The maximum likelihood Heckman selection procedure corrects for this bias (Greene 2003).

Whether or not the household chooses to move is represented by the following equation:

$$z_{i,t}^* = \mathbf{w}_{\mathbf{i},t}' \boldsymbol{\gamma}_{\mathbf{i},t} + u_{i,t} = 1 \text{ if } z_{i,t}^* > 0, \text{ and } 0 \text{ otherwise} \quad (17)$$

$z_i^*$  is not directly observed- instead, we observe only whether the household moves ( $z_i = 1$ ) or doesn't move ( $z_i = 0$ ). The quantity of housing that a household chooses to purchase,  $y_i$ , is only observed if the household moves.  $\rho$  is the correlation between the error of the selection equation (Equation 17) and the regression equation (Equation 18).

$$y_{i,t} = \mathbf{x}_{\mathbf{i},t}' \boldsymbol{\beta}_{\mathbf{i},t} + \epsilon_{i,t} \text{ observed only if } z_i^* > 0 \quad (18)$$

$$(u_i, \epsilon_i) \sim \text{bivariate normal } [0, 0, 1, \sigma_\epsilon, \rho]$$

I allow errors to be correlated across time within households, and exclude any cases for which the relative value of the new home falls in the top or bottom 1% of outliers.

The quantity of housing purchased is a function of observed covariates  $x_i$ , which include age of household head (in decades), sex of head of household, marital status (married or unmarried), whether the household is currently employed, family size, change in family size over the past 2 years, average family income over the past four years (in \$1,000's), change in family income over the past four years (in \$1,000's), and home value (in \$1,000's). Following Boehm, Herzog and Schlottman (1991) in their study of mobility, migration, and tenure choice, I include the number of moves made

by the household over the past four years to proxy for household-specific mobility preferences.

The selection equation modelling whether or not the household moves depends on most of the preceding variables, except that the change in family size is included as its absolute value. Although whether the family is growing or shrinking should affect affects whether it desires more or less housing, only the absolute value of that change should determine whether the household chooses to move. The selection equation also includes responses to the question, “Would you say you definitely will move (in the next few/ couple of years), probably will move, or are you more uncertain?”<sup>14</sup>.

Results are presented in Table 8. The first panel of the table displays estimates of the relative value of the household’s future home, and the second panel demonstrates how each covariate affects the household’s probability of moving.

Dummy variables representing each household’s self-reported likelihood of moving have the greatest numerical importance on whether or not the household moves in the next 10 years. Households that don’t plan to move are the omitted group. Households that report they “definitely” will move are much more likely to move than other households. Those that report they “probably” will move or are “more uncertain” about moving are also more likely to move than households who don’t plan to move. The probability of moving decreases with age, likely reflecting more stable employment and less need for additional space caused by growing families. Households who have moved more frequently over the past four years are, as expected, more likely to move. Households with a married or employed head are less likely to move. Those with larger families are less likely to move, having already adjusted housing consumption as needed. Neither average family income, change in family income, nor house

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<sup>14</sup>This question was asked in every wave of the sample except 1994 and 1995. In 1994, households were instead asked for the probability that they might move. I used each household’s reported probability to assign it a value of ‘definitely’, ‘probability’, ‘uncertain’ or ‘not moving’. Categorizing probabilities of less than 21 as “not moving”, between 21 and 51 as “uncertain”, between 51 and 95 as “probably” and greater than 95 as “definitely” resulted in a similar proportion of respondents in each group as is observed for 1992, 1993, and 1996.

value has much effect on the household's probability of moving.

The relative value of the future home ( $\gamma$ ) is measured relative to a base value of 100. A household that moves into a 10% more expensive home would have a trade value of 110. The estimated value of  $\gamma$  decreases with the age of the household head, consistent with the notion that older households are more likely to move into less expensive homes.  $\hat{\gamma}$  also decreases with the number of moves made by the household over the past four years. Households that are employed tend to move into more expensive homes, likely due to better future earning prospects. Households with larger families tend to move into less expensive homes. These households have likely already adjusted their housing consumption to accommodate their current household members, and any future move would be to decrease housing expenses. Growing families, represented by recent increases in family size, move into more expensive homes. The relative value of the new home also increases with higher current income, though past changes in family income have little numerically or statistically significant effect. The relative value of the future home decreases with the value of the household's current home. This likely reflects households consuming the most housing in middle age, and decreasing housing consumption later in life.

Point estimates of variables in both equations are generally statistically significant at the 5% level. The sign of each variable's effect on the household's probability of moving are also consistent with Boehm et al. (1991). A Wald test finds that independence of the moving and trade value equations can be rejected at the 1% confidence level.

I use coefficients estimated from the mobility model for data between 1975 and 2003 to predict mobility for households in the active savings sample. I calculate each household's expected value of a trade as follows, where  $\hat{\lambda}$  is the household's estimated probability of moving, and  $\hat{\gamma}$  is the predicted relative trade value. Not moving is equivalent to a relative trade value of 100.

$$E[\text{trade}] = \hat{\lambda} * (\hat{\gamma}) + (1 - \hat{\lambda}) * (100)$$

A household with zero probability of moving would have an expected trade value of 100. Households that are likely to move into more expensive homes will have expected trade values greater than 100, while households that are likely to move into less expensive homes will have trade values less than 100. The magnitude of the distance from 100 depends on both the probability of moving and the relative value of the new home.

The average sample household has a 52% probability of moving within the next 10 years, and is likely to move into a house that is 16% more expensive. Statistics summarizing predicted likelihood of moving within the next 10 years, relative trade value, and expected value of a trade are reported in Table 9.

### 3.4 Regressions Examining Effect of Mobility

I examine the effect of expected mobility by restricting Regression II to households with different mobility characteristics. If home prices move together and future mobility is an important factor in determining household savings and consumption decisions, households that expect to move into more expensive homes should increase consumption when home values rise, and households that plan to move into less expensive homes should decrease consumption when home values rise. Results for these regressions are reported in columns III and IV of Table 7.

Regression III restricts the sample to households with (predicted) expected trade values greater than 105% of their current home's value. This group includes households with high probabilities of moving into slightly more expensive homes, and households with low probabilities of moving into much more expensive homes. Restricting the sample to households that are predicted to move into more expensive homes has

little effect on the young group of households. The coefficient on housing gains for young households (the omitted group) is 0.14, and is statistically significantly different from zero at the 10% level.

Summarizing predicted expected trade values by age helps explain why restricting the sample to households that expect to move into more expensive homes has very little effect on the estimated response for young households. As shown in Table 10, the average young household has an expected trade value of 116. Restricting the sample to households with trade values greater than 105 eliminates less than 25% of young households.

Surprisingly, restricting the sample to households that expect to move into more expensive homes results in larger savings offsets for the middle aged and older groups of households. The estimated  $MPC_{GAINS}$  for the middle aged group of households is approximately 0.05, much larger than the 0.01 cent estimated for the entire sample. Older households have a savings offset that is 27 cents lower than that of young households, equivalent to an estimated  $MPC_{GAINS}$  of 0.13.

The increased savings offset for middle and older households may reflect greater substitutability between housing and non-housing consumption for those groups of households. Unlike younger households, older households are less likely to require more space to accommodate growing families. Older households who are more likely to move into more expensive homes may more readily substitute towards non-housing consumption if home prices rise, rather than increasing non-housing savings so that they can afford a more expensive home in the future. These households may also substitute towards housing consumption if home prices fall.

The estimated coefficients on stock market gains become slightly more negative than those in Regression II, though they are still not significantly different from zero at the 10% level. Coefficients on average family income and change in family income are largely unchanged from those estimated using the full sample.

Regression IV restricts the sample to households with (predicted) expected trade values less than 90% of their current home's value<sup>15</sup>. The pattern of coefficients across age groups remains similar those estimated using the entire sample- young households have positive responses, while the middle aged and older groups of households have slightly negative responses. The coefficient on housing gains for young homeowners becomes more positive- the opposite direction than what is expected. Young households (the omitted group) that are predicted to move into less expensive homes increase non-housing active savings by 49 cents for each dollar in housing gains. Though this estimate has a large standard error, a 95% confidence interval around the estimate still excludes zero. One possible explanation for this puzzle is that very few young households actually expect to move into less expensive homes. Examination of responses to the PSID question "Why might you move" supports this hypothesis. Between 1975 and 1993 (years for which detailed responses to this question were available), only 0.6% of households in the youngest age group reported that they might move to contract housing, compared to 1.3% of the middle aged group and 2.3% of the older group. The positive relationship between active savings and home prices for young homeowners may reflect their general expectation that any move would be into a more expensive home. Even if young households expect their probability of migrating to a different area to be high, they may respond to the uncertainty of whether it would be a more or less expensive area by increasing savings when their own home price rises.

Another explanation is that some young homeowners do plan to move into less expensive homes, and that they are reallocating wealth in anticipation of future changes in housing consumption. If households respond to rising prices by using home equity to purchase non-housing assets, the coefficient on housing gains will have a positive

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<sup>15</sup>I also try restricting the sample to households with expected trade values less than 95% of their current home's value, however, an F-test can't reject joint insignificance of all of the explanatory variables at the 10% level.

bias.

Estimates from the restricted sample for middle-aged and older households move in a direction that is consistent with the model's predictions. With point estimates of -0.03 and -0.02, respectively, these coefficients are slightly more negative than those in Regression III. Tables 1 and 2 suggest that if households plan to move into homes that are initially 50% less expensive 5 years in the future, households in the middle age group should offset savings by approximately 4 cents for each dollar in housing gains, and households in the older age group should offset savings by approximately 7 cents. The theoretical coefficients for both of these age groups fall easily within the 95% confidence intervals around the coefficient estimates for these groups of homeowners.

The coefficient on average family income, which was positive in the full sample, is negative and not statistically significant in the restricted sample.

## 4 Conclusion

This paper demonstrates how age and expected mobility should affect the responsiveness of consumption and saving behavior to capital gains. Section 2 demonstrates that the theoretical  $MPC_{GAINS}$  is an increasing function of age and a decreasing function of the relative initial value and appreciation rate of a future home. The effect of mobility on  $MPC_{GAINS}$  decreases with the time until a move. This paper also illustrates how the response of consumption to housing capital gains should differ from the response of consumption to changes in the value of other types of assets, such as stock market gains.

This paper is the first to establish a significant empirical link between housing and consumption using household-specific fixed effects on a true data panel. Section 3 of this paper illustrates the importance of allowing responses to housing

gains to vary by age. Restricting the coefficient on capital gains to be constant across households may explain why Juster et al. (2006) find no significant effect of housing on active savings, despite using a similar fixed effects strategy on PSID data. I find that households under the age of 35 increase active savings by approximately 15 cents for each dollar in housing gains, equivalent to an  $MPC_{GAINS}$  of -0.15. Households aged 35-50 decrease active savings between 1 and 5 cents for each dollar in housing gains ( $MPC_{GAINS}$  in the range of 0.01 and 0.05), and households aged 50 and over decrease active savings by up to 13 cents for each dollar in housing gains ( $MPC_{GAINS}$  equal to 0.13.) Regression results support the theory that mobility also affects  $MPC_{GAINS}$ , though not always as expected. For homeowners aged 35 and over, restricting the sample to those that expect to move into less expensive homes results in a slightly larger  $MPC_{GAINS}$ .

Empirical results also highlight the importance of separating capital gains into different asset classes. The theory presented in Section 2 illustrates that asset classes are not fungible- a dollar in housing capital gains should have a different impact on consumption than a dollar in stock capital gains, even in the absence of market frictions. My estimates support the aggregate-level results of Case et al. (2005) that find housing gains have a larger impact on consumption than stock market gains.

## 5 Tables

Table 1:  $MPC_{GAINS}$  by Age (Not Moving;  $\theta = 1, \gamma = 1$ )

<b>Lifetime</b>	<b>Tenure</b>					
<b>(Age)</b>	1	5	10	20	40	60
1 (100+)	0.500					
5 (89)	0.154	0.154				
10 (77)	0.077	0.077	0.077			
20 (62)	0.034	0.034	0.034	0.034		
40 (39)	0.012	0.012	0.012	0.012	0.012	
60 (18)	0.005	0.005	0.005	0.005	0.005	0.005

Table 2: Marginal Effect of Mobility on  $MPC_{GAINS}$ — Future home has same price appreciation, and is initially 50% less expensive

<b>Lifetime</b>	<b>Tenure</b>					
<b>(Age)</b>	1	5	10	20	40	60
1 (100+)	0.000					
5 (89)	0.095	0.000				
10 (77)	0.062	0.050	0.000			
20 (62)	0.044	0.037	0.029	0.000		
40 (39)	0.034	0.029	0.024	0.016	0.000	
60 (18)	0.031	0.027	0.023	0.016	0.007	0.000

Table 3: Marginal Effect of Mobility on  $MPC_{GAINS}$ – Future home has same price appreciation, and is initially 50% more expensive ( $\theta = 1, \gamma = 1.5$ )

<b>Lifetime</b>	<b>Tenure</b>					
<b>(Age)</b>	1	5	10	20	40	60
1 (100+)	0.000					
5 (89)	-0.095	0.000				
10 (77)	-0.062	-0.050	0.000			
20 (62)	-0.044	-0.036	-0.029	0.000		
40 (39)	-0.034	-0.029	-0.024	-0.016	0.000	
60 (18)	-0.031	-0.027	-0.023	-0.016	-0.007	0.000

Table 4: Marginal Effect of Migration on  $MPC_{GAINS}$ – Future home has double the price appreciation, and is initially 50% more expensive ( $\theta = 2, \gamma = 1.5$ )

<b>Lifetime</b>	<b>Tenure</b>					
<b>(Age)</b>	1	5	10	20	40	60
1 (100+)	0.000					
5 (89)	-0.381	0.000				
10 (77)	-0.249	-0.201	0.000			
20 (62)	-0.175	-0.146	-0.115	0.000		
40 (39)	-0.136	-0.117	-0.097	-0.064	0.000	
60 (18)	-0.125	-0.109	-0.091	-0.064	-0.029	0.000

Table 5: Illustration of Potential Effects of Inheritances, Gifts, and Transfers of Assets by Movers In and Out on Active Savings

	<b>Inheritance Type</b>	<b>A Inheritance Amount</b>	<b>B <math>\Delta</math> Wealth</b>	<b>C Capital Gains</b>	<b>B-A-C Active Saving</b>
1	Non-home property	\$10,000	\$10,000	\$10,000 ( $\Delta$ property value)	-\$10,000
2	Cash	\$10,000	\$10,000	\$0	\$0

Consider a household that receives an inheritance of real estate worth \$10,000 in 1994. In response to the question “During the last five years, have you (or anyone in your family living there) received any inheritances of money or property worth \$10,000 or more?” (G228, 1994) the household responds “yes”, and to the question “How much was it worth altogether, at that time?” (G230, 1994) the household responds “\$10,000”.

The inheritance would increase the “real estate” asset category by \$10,000. The household would likely answer “No” to the question “Since January 1989, did you (or anyone in your family living there) buy any real estate other than your main home, such as a vacation home, land, or rental property?” (question G164, 1994), causing the increase in real estate holdings due to the inheritance to be attributed to capital gains. Both inheritances and capital gains are subtracted from the change in total wealth, resulting in an active saving decrease of \$10,000.

If instead the household instead inherited \$10,000 cash, it would cause non-home wealth to rise by \$10,000 without affecting capital gains. The cash inheritance would have no effect on active savings.

Transfers of assets into or out of the household by people moving would similarly affect results.

Table 6: Number of Cases with Inheritances, Transfers, and Outlying Observations

		1989	1994	1999	2001	2003
Inheritance/ Transfers	455	437	454	318	320	
<b>1% Outliers</b>						
Home % kgains						
	high	34	44	32	33	33
	low	34	43	32	33	39
Home % kgains, periodic effect		211	298	243	66	72
Active Saving						
	high	48	49	42	57	60
	low	48	49	42	57	60
Average family income						
	high	74	120	104	75	79
Change in family income						
	high	53	56	50	63	67
	low	53	56	50	63	67
Total Outliers (full set, some intersect)		435	567	495	325	357

Table 7: Active Savings is Dependent Variable

	<b>I</b>	<b>II</b>	<b>III</b>	<b>IV</b>	<b>Means</b>	<b>Means</b>
	<b>Baseline</b>	<b>Interact Age, Gains</b>	<b>Likely Up</b>	<b>Likely Down</b>	<b>Full Sample</b>	<b>Drop Outliers</b>
Active Saving					1778.94 (562.67)	1888.47 (170.08)
Age 35-49	-339.59 (1020.48)	-346.66 (1019.70)	278.40 (1332.77)	18812.84 ( 11165.50)	42.24 (4.14)	42.21 (4.14)
Age 50+	2202.33 (1557.53)	2197.86 (1555.37)	4755.42 (2455.51)	18404.40 (11626.11)	63.90 (10.35)	63.68 (10.28)
House K Gain	0.00 (0.01)	0.15 (0.06)	0.14 (0.08)	0.49 (0.21)	1277.72 (140.81)	1194.59 (95.79)
(Age 35-49)*home gains		-0.16 (0.07)	-0.19 (0.09)	-0.52 (0.22)		
(Age 50+)*home gains		-0.16 (0.07)	-0.27 (0.09)	-0.51 (0.21)		
Stock K Gain	-0.01 (0.00)	-0.05 (0.11)	-0.10 (0.11)	-0.90 (0.63)	756.10 (1488.46)	684.69 (670.20)
(Age 35-49)*stock gains		0.03 (0.11)	0.03 (0.11)	0.90 (0.63)		
(Age 50+)*stock gains		0.04 (0.11)	0.10 (0.11)	0.88 (0.63)		
Avg. fam Y	0.07 (0.02)	0.07 (0.02)	0.09 (0.05)	-0.04 (0.06)	62534.10 (628.46)	55884.87 (324.29)
$\Delta$ in famY	0.02 (0.05)	0.03 (0.05)	-0.01 (0.09)	0.07 (0.15)	1722.15 (198.75)	1661.02 (66.83)
Observations	11158	11158	4630	2491	12381	11183
Households	5195	5195	2680	1489		

Standard errors are in parentheses. Intercept and year coefficients are excluded.

Housing gains are calculated using annual and biannual data, while other variables are available less frequently. Thus, mean housing gains are calculated from more observations than other variables.

“Likely up” includes households with expected trade values greater than 105.

“Likely down” includes households with expected trade values less than 90.

Table 8: Mobility Estimates: Heckman Selection Model

<b>Variable</b>	<b>Coefficient</b>	<b>(Std. Err.)</b>
Equation 1 : Relative Trade Value (100=same price)		
Age (in decades)	-9.63	(2.06)
# moves in past 4 years	-13.49	(1.82)
Married (1=yes)	23.85	(6.16)
Currently employed (1=yes)	22.44	(6.16)
Family size	-7.30	(1.64)
$\Delta$ family size	4.91	(1.64)
Average family Y (in \$1000's)	0.54	(0.07)
$\Delta$ family income (in \$1000's)	0.06	(0.04)
House value (in \$1000's)	-0.39	(0.04)
Equation 2 : Selection Equation- Probability of Moving		
will "definitely" move within 3 yrs.	1.33	(0.05)
"probably" move within 3 yrs.	0.87	(0.04)
"uncertain" about moving	0.61	(0.04)
Age (in decades)	-0.13	(0.01)
Sex of head (1=male)	0.27	(0.07)
# moves in past 4 years	0.25	(0.02)
Married (1=yes)	-0.26	(0.06)
Currently employed (1=yes)	-0.24	(0.04)
Family size	-0.06	(0.01)
$\Delta$ family size, absolute value	-0.01	(0.01)
Average family Y (in \$1000's)	0.00	(0.00)
$\Delta$ family income (in \$1000's)	0.00	(0.00)
House value (in \$1000's)	0.00	(0.00)
athrho	-0.14	(0.03)
lnsigma	4.98	(0.08)

Table 9: Summary Statistics: Likelihood of Moving, Relative Trade Value

Estimated Variable	Mean	Standard Deviation
Probability of Moving within next 10 years- $\hat{\lambda}$	0.52	0.19
Relative Trade Value $\hat{\gamma}$	116.58	86.95
E[Trade]	102.2	29.4

Table 10: Predicted Expected Trade Value, by Age

Age Group	Mean	Standard Deviation
Age < 35	115.96	25.50
Age 35-49	105.37	29.65
Age 50+	93.45	27.68

## A Marginal Propensity to Consume

This section derives the household's consumption function and calculates theoretical estimates of the marginal propensity to consume out of wealth ( $\mu$ ). Assume households have constant relative risk aversion (CRRA) utility and stochastic discount factor  $\beta$ . Each period, households have the option to consume ( $c$ ) or save in risk-free asset  $A$ . Lifetime utility is given by equation 19.

$$U = \sum_{t=1}^T \beta^t \frac{c_t^{1-\theta}}{1-\theta} \quad (19)$$

The lifetime budget constraint equates the present values of consumption and wealth:

$$\sum_{t=1}^T \frac{c_t}{(1+r_t)^t} \leq A_o + \sum_{t=1}^T \frac{y_t}{(1+r_t)^t} \quad (20)$$

Maximization of 19 subject to 20 yields the Euler Equation

$$c_{t+1} = c_t (\beta R)^{\frac{1}{\theta}} \quad (21)$$

Combining 20 and 21 yields the household consumption function, where  $R_t = (1+r_t)$ :

$$c_t [1 + (\beta R)^{\frac{1}{\theta}} R^{-1} + (\beta R)^{\frac{2}{\theta}} R^{-2} + \dots + (\beta R)^{\frac{T}{\theta}} R^{-T}] = A_o + \sum_{t=0}^T \frac{y_t}{(1+r_t)^t} \quad (22)$$

Equation 22 shows that the the marginal propensity to consume ( $\mu$ ) is equal to  $\frac{1}{1 + \sum_{t=1}^T ((\beta R)^{\frac{1}{\theta}} R^{-1})^t}$  for the finite-lived consumer. For the infinite-lived consumer,  $\mu = 1 - R^{-1} (\beta R)^{\frac{1}{\theta}}$ .

$$c_t = \mu \left[ A_o + \sum_{t=0}^T \frac{y_t}{(1+r_t)^t} \right]$$

If  $\beta = 0.97$ ,  $\theta = 0.8$ , and  $R = 1.032$ ,  $\mu$  for the infinite-lived consumer is 0.03. Estimates of  $\mu$  for finite-lived consumers range from 0.500 to 0.034 depending on expected future lifespan.

Lifetime (Age)	$MPC_{WEALTH} = \mu(T)$
1 (100+)	0.500
5 (89)	0.175
10 (77)	0.102
20 (62)	0.062
40 (39)	0.041
60 (18)	0.034
$\infty$	0.030

## References

- Arias, Elizabeth**, *United States Life Tables, 2002.*, Vol. 53 of *National Vital Statistics Reports*, Hyattsville, MD: National Center for Health Statistics, 2004.
- Boehm, Thomas, Henry Herzog, and Alan Schlottman**, “Intra-Urban Mobility, Migration, and Tenure Choice,” *The Review of Economics and Statistics*, February 1991, 73 (1), 59–68.
- Bostic, Raphael, Stuart Gabriel, and Gary Painter**, “Housing Wealth, Financial Wealth, and Consumption: New Evidence from Micro Data,” *Lusk Center for Real Estate Working Paper*, December 2005, (2004-1005).
- Campbell, John and Joao Cocco**, “How do house prices affect consumption? Evidence from micro data”, by John Campbell and Joao Cocco,” *NBER Working Paper*, 2005, (11534).
- Case, Karl, John Quigley, and Robert Shiller**, “Comparing Wealth Effects: The Stock Market versus the Housing Market,” *Advances in Macroeconomics*, 2005, 5 (1).
- Dougherty, Ann and Robert Van Order**, “House prices and home owner saving behavior,” *American Economic Review*, March 1982, 72 (1), 154–164.
- Engelhardt, Gary**, “House prices and home owner saving behavior,” *Regional Science and Urban Economics*, 1996, 26, 313–336.
- Feenberg, Daniel and Elizabeth Coutts**, “An Introduction to the Taxsim Model,” *Journal of Policy Analysis and Management*, Winter 1993, 12 (1).
- Greene, William H.**, *Econometric Analysis*, fifth ed., Prentice Hall, 2003.
- Juster, F. Thomas, Joseph P. Lupton, James P. Smith, and Frank Stafford**, “The Decline in Household Saving and the Wealth Effect,” *The Review of Economics and Statistics*, February 2006, 88 (1).
- Li, Wenli and Rui Yao**, “The Life Cycle Effects of House Price Changes,” *forthcoming, Journal of Money, Credit and Banking*, 2006.
- Poterba, James**, “Tax Subsidies to Owner-Occupied Housing: An Asset-Market Approach,” *The Quarterly Journal of Economics*, 1984, 99 (4).

**Skinner, Jonathan**, “Housing Wealth and Aggregate Saving,” *Regional Science and Urban Economics*, 1989, (19), 305–324.